Innovative Distributed Power Interconnection and Control Systems

Bill Liss
Gas Technology Institute
Larry Adams
Encorp, Inc.

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Program Goals

- Cost-effective DP grid interconnection products, software, and communication solutions
- Improved economics for broad range of DP power systems
- Enhanced DP product capability to integrate, interact, and provide operational benefits
  - Within building energy management systems and electric power systems

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Spectrum of Products

- **Conventional Technologies**
  - **Engines and Turbine Generators**
    - Natural gas, diesel, biomass
  - **Small Steam Turbines**
- **Emerging Technologies**
  - **Microturbines**
  - **Fuel cells**
- **Renewable Technologies**
  - **Wind**
  - **Solar/PV**
  - **Small Hydro**

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Work Plan – Three Phases

- Core Enabling Technology and Software Development
  - Base Year
  - Enhancement to Encorp's core GPC Product (Generator Power Control)
- Application and System Level Command and Control
  - Option Year One
- Further Development and Validation of Industry Communication Standards
  - Option Year Two

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Program Plan/Tasks

	Core Enabling Technology
(1)	Develop Prototype Advanced Controller
(2)	Develop Prototype Power Sensing Board
(3)	Expanded Suite of Communication Capabilities
(4)	Interface for Revenue-Grade Meter
(5)	Demonstrate Interconnect DP Device
	System Level Command & Control
(6)	Type Testing
(7)	System Command and Control
(8)	Demonstration of Controlled DP
	Interoperability & Communications
(9)	Interoperability Systems Analysis
(10)	Demonstration of Grid-DP Interoperability

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Core Enabling Technology
GPC II Enhancements

- Performance
- Communications
- Scalability
- IEEE P1547 Compliant
- Functionality
- Programmability
- Serviceability
- Lower System Cost

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GPC II Performance Enhancements

- Goal: Improve Processing Speed
  - Enable high speed digital signal processing (DSP)
  - More rapid event recognition and response
- PowerPC CPU – Provides 10x Performance Improvement
- DSP in Power Sensor – Single Cycle Power Measurements
- Together, These Provide 20x improvement In Performance Over Current Designs

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GPC II Communications Enhancements

- Goal: Suite of Communication Options To Enable Flexible Inter-Device & Network Connectivity
  - Tie-In With Various Generators/Prime Mover Controls, Building Energy Management Systems, and Network Controllers
- LonWorks
- 10/100 Ethernet channel
- (2) CAN/DeviceNet channels
- (2) RS-232/485 channels

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GPC II Scalability Enhancements

- Goal: Flexible Design Platform To Meet Cost & Feature Requirements of Both Small & Large Generators
- Increased Standard Input/Output (I/O)
- Optional I/O Module
- Multiple Power Sensor Modules
- Accepts 2 M-Modules
- More Networked I/O Options

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GPC II P1547 Standard Compliant

- Goal: Product Enhancement To Meet/Exceed Standard
- Improved Protective Relay Performance
- New Loss of Synchronism Relay
- New Islanding Detection Relay
- Increased EMI and Surge Withstand Immunity

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GPC II Functional Enhancements

- Accept Multiple Power Sensors
  - Second 3-phase sensor on bus
  - Over-current relay
  - Differential current relay
- Revenue Grade Metering Accuracy
- Internet Connectivity
- Data Logging
- Sequence of Events Logging
- Alarming
- Trending

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Current Status and Issues

- **Functional Product Specifications Have Delayed Schedule**
  - **Selection of more powerful processor will require added effort in terms of software and migration**
- **Prototype Field Testing Delayed**
  - **Will not be completed within Base Year**

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Summary

- Program is underway in terms of core technology development
  - High performance platform selected
- Exploring options for type testing in Option Year One
- Product Launch Expected In 2002

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